rather than fetal calf serum and the omission of hormones from the maturation culture medium. A favourable effect from using oestrous cow serum has been observed by other workers (Sanbuissho and Threlfall 1985) but the culture of oocytes in the absence of hormones has not previously been reported.

Most calves born after in vitro fertilsation have so far originated from in vivo matured oocytes transferred surgically to recipient cattle (Brackett and others 1982) or after using the rabbit oviduct as an incubator for four to five days (Sirard and Lambert 1986). One pregnancy was reported by Critser and others (1986) after in vitro fertilisation of in vitro matured oocytes and using the sheep oviduct as the in vivo culture system to bring eggs to the morula stage. Recently, in Japan, Hanada and others (1986) have reported the birth of three calves after the in vitro fertilisation of in vitro matured oocytes and using the rabbit oviduct as a temporary incubator. The present findings differ from such reports in the high percentage (60 per cent) of oocytes which had cleaved to the morula or blastocyst stage of development when recovered from the ewe oviduct. Taken together with the evidence of a normal pregnancy rate in the recipient cattle, there are indications that a reliable in vitro fertilisation system has been established which may be the means of providing supplies of cattle embryos cheaply. Previous observations in this laboratory have shown that beef heifer ovaries contain numerous vesicular follicles. Scanlon (1969) recorded an average of 45 follicles per animal and similar figures have been reported elsewhere (Leibfried and First 1979). It should be possible, therefore, to make use of such ovaries in the development of a new approach to cattle embryo transfer technology. There is an obvious need to concentrate research on the development of effective in vitro culture methods for the early cattle embryo, to avoid the need to use sheep as an intermediate host. There are reasonable grounds for believing that this can be done by using bovine oviductal cell monolayer techniques (Lu and others 1987c).

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References

BRACKETT, G. B., BOUSQUET, D., BOICE, M. L., DONAWICK, W. L., EVANS, J. F. & DRESSEL, M. A. (1982) *Biology of Reproduction* **27**, 147
CRITSER, E. S., LEIBFRIED-RUTLEDGE, M. L. & FIRST, N. L. (1986) *Biology of Reproduction* **34** *(Supplement 1)* 286
HANADA, A., ENYA, V. & SUZUKI, T. (1986) Proceedings of the 78th Meeting of the Japanese Society of Zootechnical Science, 1–36 p18
LEIBFRIED, L. & FIRST, N. L. (1979) *Journal of Animal Science* **48**, 76
LU, K. H., BOLAND, M. P., CROSBY, F. T. & GORDON, I. (1987a) *Theriogenology* **27**, 251
LU, K. H., BOLAND, M. P., CROSBY, F. T. & GORDON, I. (1987b) *Animal Production* **44**, *468*
LU, K. H., GORDON, I., CHEN, H. B. & McGOVERN, H. (1987c) Proceedings of the European Embryo Transfer Meeting Lyon. (In Press)
MOOR, R. M. & TROUNSON, A. O. (1977) *Journal of Reproduction and Fertility* **49**, 101
MOOR, R. M., OSBORN, J. C. & CROSBY, I. M. (1981) Follicular Maturation and Ovulation. Eds R. Roland and others. Amsterdam, Excerpta Medica, Elsevier. p249
MOOR, R. M., KRUIP, Th.A.M. & GREEN, D. (1984) *Theriogenology* **21**, 103
PARRISH, J. J., SUSKO-PARRISH, J. L., LEIBFRIED-RUTLEDGE, M. L., CRITSER, E. S., EYESTONE, W. H. & FIRST, N. L. (1986) *Theriogenology* **25**, 591
SANBUISSHO, A. & THRELFALL, W. R. (1985) *Theriogenology* **23**, 226
SCANLON, P. F. (1969) PhD thesis, National University of Ireland, Dublin
SIRARD, M. A. & LAMBERT, R. D. (1986) *Veterinary Record* **119**, 167
SREENAN, J. M. (1968) Proceedings of the 6th International Congress of Reproduction and Artificial Insemination (Paris) **1**, 577
SREENAN, J. M. (1970) *Journal of Agricultural Science, Cambridge* **75**, 393
THIBAULT, C. (1977) *Journal of Reproduction and Fertility* **51**, 1

Comparison of serological responses in cats vaccinated with two different FeLV vaccine preparations

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TO assess the potential of a commercial feline leukemia virus (FeLV) vaccine (Leukocell; Norden) and a candidate subunit ISCOM FeLV vaccine (Osterhaus and others 1985) to induce protective immunity in cats against FeLV infection under field conditions, the authors conducted a comparative trial in three groups of privately owned cats, kept under conventional conditions in single or multiple households. Two groups of animals were vaccinated three times either with Leukocell, or with the candidate ISCOM vaccine, both containing about the same amount of FeLV envelope glycoprotein (gp70). The third group was inoculated at the same intervals with a control preparation not containing FeLV antigen. Serological responses were measured with an enzyme-linked immunosorbent assay (ELISA), a membrane immunofluorescence test and in a virus neutralisation test before (day 0) and after vaccination (day 100). In none of the cats could FeLV antigen be demonstrated in an immunofluorescence test carried out on their blood smears before and after vaccination (Jarrett and others 1982).

In the group of cats with Leukocell (n = 47), 35 were seronegative in the ELISA (titre less than 30) and 12 seropositive (titre more than 30) before the start of the experiment. During the experiment, only five (14 per cent) of the 35 seronegative animals showed seroconversion in the ELISA, six (17 per cent) using the membrane immunofluorescence test and two (6 per cent) in the virus neutralisation test. Of the 12 seropositive animals in this group two (17 per cent) showed a titre rise using the ELISA, three (25 per cent) using membrane immunofluorescence and two (17 per cent) with virus neutralisation.

In the group of cats vaccinated with the candidate ISCOM subunit FeLV vaccine (n = 44), 35 were seronegative in the ELISA and nine seropositive before the start of the experiment. During the experiment 34 (97 per cent) of the 35 seronegative animals showed seroconversion in ELISA, 29 (83 per cent) in the membrane immunofluorescence test and 28 (81 per cent) using virus neutralisation. Of the nine seropositive animals in this group, seven (78 per cent) showed a titre rise in ELISA, eight (89 per cent) in membrane immunofluorescence and six (67 per cent) in virus neutralisation. In the group of cats inoculated with the control preparation (n = 46), 42 were seronegative in ELISA and four seropositive before the start of the experiment. During the experiment no seroconversions or titre rises were measured in any of the three tests in any of these cats.

It was not only shown that a much higher percentage of the cats vaccinated with the ISCOM preparation responded in all three tests, but also that their absolute antibody titres including virus neutralising titres proved considerably higher than those of the cats vaccinated with the other vaccine preparation.

References

JARRETT, O., GOLDER, M. C. & WEIJER, K. (1982) *Veterinary Record* **110**, 325
OSTERHAUS, A., WEIJER, K., UYTDEHAAG, F., JARRETT, O., SUNDQUIST, B & MOREIN, B. (1985) *Journal of Immunology* **135**, 591

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